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Authors of papers intended for publication in Food Technology should request from the Editor's office a copy of a booklet, titled "Suggestions to Authors," and see that their papers are in the form specified therein before they are sent to the editor.

The Institute of Food Technologists assumes no responsibility for statements in contributed articles appearing in Food Technology. Editorials present only opinions of the writers and do not necessarily reflect policies of the Institute of Food Technologists.

Abstracts

(Continued from page 2)

292I. Bacteriostasis in the amino-acid series. I. Derivatives of alanine.

ELLIOTT, D. F., FULLER, A. T., AND HARINGTON, C. R. *J. Chem. Soc.*, 85-9 (1948).

It is known that inhibition of bacterial growth can be effected by structural analogues of naturally occurring amino-acids; it is also known that all natural aromatic and heterocyclic amino-acids are β-substituted alanines. These considerations led to a search for antibacterial activity among alanines substituted in the β-position by pyridine, quinoline, and basic derivatives of benzene. Significant inhibitory actions have been observed with three compounds, β-ω-amino-ρ-tolylalanine, β-6-methoxyquinoly (4) alanine, and β-pyridyl (4) alanine; these inhibit haemolytic streptococcus in broth in the range 1:2000 to 1:5000, and the last shows some action against *B. coli* in synthetic medium.

293I. The determination of the holding time in high-temperature, short-time pasteurizing units.

JORDAN, W. K., HOLLAND, R. F., AND WHITE, J. C. *J. Milk Food Tech., 12,* 87-92 (1949).

Dye, salt, and bacteria were used to measure holding time in high-temperature short-time pasteurization units. Apparatus and techniques are described.

NUTRITION

294I. Food habits of freshmen at Oregon State College.

YOUNG, C. B., AND STORVICK, C. A. *J. Am. Diet. Assn., 25,* 318-21 (1949).

Sixty-four percent of the subjects had fair diets, 19% had good diets, and 17% had poor diets. Freshman men had better diets than freshman women. Breakfast consumption showed a direct relationship to diet score. No correlation was made between dietary histories and the condition of the teeth, since the dietary records were based on the present food habits of the subjects and did not necessarily reflect their food habits before they came to college.

295I. Cobalt deficiency among sheep in New Hampshire.

KEENER, H. A., PERCIVAL, G. P., AND MORROW, K. S. *J. Anim. Sci., 7,* 16-25 (1948); *Brit. Abst., BIII, 25,* Jan., 1949.

Although only border-line cases were encountered in field studies (the deficiency was due to Co-deficient hay grown locally), the average gain in weight of sheep receiving 2 mg. of Co per day per head was 2.5 times that of the untreated controls.

296I. Some effects of feeding thyroprotein to dairy cows during their first lactation.

THOMAS, J. W., MOOR, L. A., AND SYKES, J. F. *J. Dairy Sci., 32,* 278-91 (1949).

If extra feed is not fed, the cows show a period of stimulated milk production followed by a rapid decline. When extra feed (25% over requirement) and thyroprotein were fed simultaneously, high production was maintained throughout lactation. The gross efficiency for milk production apparently was unaltered by feeding thyroprotein. Also the net efficiency for the corresponding level of nutrient intake was unchanged. The percent fat in the milk of thyroprotein fed cows was increased above that of normally fed cows for a period of only 30 to 40 days. The heart rate was increased by feeding thyroprotein. Poor producing cows respond less than do good producers. It is not possible to make a good producer out of a bad producer by feeding thyroprotein.

297I. Further observations on the effect of protein upon roughage digestion in cattle.

BURROUGHS, W. et al. *J. Animal Sci., 8,* 9-18, Feb., 1949.

Improvement in roughage digestion occurred in every series with dried skim milk additions where starch formed a part of the ration. Little or no improvement in corncob digestion was noted with dried skim milk addition when no starch was fed. The protein requirement for efficient roughage digestion in cattle is extremely low when roughages are fed in the absence of starch or starchy grains. When starch forms a part of the ration, the need for protein supplement, dried skim milk, is increased in maintaining roughage digestion. Further study is needed as to the exact method by which starch increases the protein supplement needs for efficient roughage digestion in ruminants.

FOOD PRODUCTS

CANNED FOODS

298I. Effect of storage on vitamins and quality in canned foods.

FEASTER, J. F., TOMPKINS, M. D., AND PEARCE, W. E. *Food Res., 14,* 25-39, Jan.-Feb., 1949.

In storage, ascorbic acid and thiamin are the vitamins most affected. Beyond initial short storage periods, temperature is of most importance. At 21° C. retention of these vitamins is 75 to 90%. Other vitamin retentions are even higher. Quality is also influenced by storage conditions. At 21° C. or below, most canned foods suffer marked changes after 1 year. Some canned foods are better stored under refrigerated conditions.

299I. Effect of pH on thermal process requirements of canned foods.

SOGNEFEST, P., et al. *Food Res., 13,* 400-16 (1948).

Thermal death time tests were carried out on freshly prepared vegetable purees of asparagus, green beans, beets, carrots, white and yellow corn, peas, sweet potatoes, pumpkin, and spinach, to which various amounts of HCl and NaOH were added in order to modify the natural pH values. Heating tests on a standardized spore suspension of N. C. A. 3679 and, to a smaller extent, spores of *Cl. botulinum*, were made in vegetable puree within the pH range of 4.5 to 9. Spoilage results indicate that the lower the pH of raw vegetable within the range of 4.5 and 9, the lower the sterilizing value needed to insure a commercially sterile product. Thermal processing of nonacid foods tends to lower the pH. In general, the higher the pH of the product before heating, the greater the effect of heat in lowering the pH. The higher temperature equivalent processes caused less pH reduction than did the lower temperature processes in the range of 260 to 230° F.

CEREALS AND GRAINS

300I. Effect of varying concentrations of certain metals and their salts on gas production and loaf volume.

FINNEY, K. F., MCCAMMON, J. F., AND SCHRENK, W. G. *Cereal Chem., 26,* 140-7 (1949).

Spectrographic examination of filings from the planetaries of a new 100 g. bread dough mixer indicated the presence of cadmium. Cadmium was also detected spectrographically in the ash of bread baked from dough mixed in the new mixer. These cadmium-plated planetaries materially inhibited yeast fermentation, thereby resulting in reduced gas production and loaf volume.

Gas production and bread-baking studies were carried out with varying concentrations of cadmium and its chloride along with the salts of other important metals (chromium, nickel, tin, zinc, copper, magnesium, and manganese) used in plating and in aluminum and steel alloys. Salts of lead and mercury were included for academic reasons.

The enzymes of yeast are inactivated either completely or in part by certain of these metallic salts regardless of concentrations, and by others only at specific concentrations. As little as 1 p.p.m. cadmium chloride produces a material reduction in yeast activity and loaf volume.

Chromium, nickel, or tin, and preferably the first two, are biologically safe when used for plating surfaces that come in contact with yeast-fermented doughs.

301I. Hygroscopic equilibria of whole kernel corn.

BROCKINGTON, S. F., DORIN, H. C., AND HOWERTON, H. K. *Cereal Chem., 26,* 166-73 (1949).

The relative humidities of air in equilibrium with shelled yellow corn conditioned to moisture contents between 9.4 and

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Abstracts

(Continued from page 4)

22.6% were determined at 80° ± 0.2° F. with a new type of electric hygrometer. Moisture determinations were carried out with the Brown-Duvel apparatus as well as by a two-stage vacuum oven technique in which the second stage involved drying at 135° C. in a vacuum oven for 5 hours. The critical moisture content of shelled, yellow corn for safe storage, namely that in equilibrium with a relative humidity of 75% was found to be 13.8 ± 0.2% by the Brown-Duvel method and 14.7 ± 0.1% by the two-stage vacuum oven technique.

FRUIT AND FRUIT JUICES

302I. Apple as a source of vitamin C.

POLLARD, A., KIESER, M. E., AND BRYAN, J. D. *Ann. Rept. Agr. Hort. Research Sta., Long Ashton,* 200-2 (1945); *Chem. Abst., 43,* 2338c (1949).

The vitamin C contents of numerous varieties of English apples are recorded. Cider varieties generally showed the highest values (9.1-34.1 mg. per 100 g. of fresh tissue).

303I. Vitamin C content and juice quality of exposed and shaded citrus fruits.

WINSTON, J. R., AND MILLER, E. V. *Food Res., 13,* 456-60 (1948).

Vitamin C content was found to be significantly higher in fruit from outside branches than in those from inside branches of the same tree. This was true for all varieties of round oranges studied as well as for Temple Oranges and Barcy Tangerines. Percentage of total soluble solids was significantly higher in the exposed fruit of all varieties tested.

304I. Ascorbic acid content and sugar-acid ratios of fresh fruit and processed juice of tomato varieties.

SCOTT, L. E., AND WALLS, E. P. *Proc. Amer. Soc. Hort. Sci., 50,* 269-72 (1947); *Biol. Abst., 22,* 2366, No. 23519 (1948).

Ascorbic acid content of fresh fruit of 11 varieties ranged from 17.1 to 25.1 mg. per 100 g. Ascorbic acid content of processed juice stored 8 weeks was 84.6% that of fresh fruit and 85.7% that of raw juice immediately after extraction. Varietal differences were not sufficiently great to justify selection of any variety tested for manufacture of juice of high ascorbic acid content. Total acidity of fresh fruit, expressed as citric, ranged from 0.273 to 0.416%. Acidity of processed juice ranged from 0.376 to 0.537%. Sugar content of the fresh fruit ranged from 2.28 to 3.58% among varieties. Sugar-acid ratios of the juices were in close agreement with organoleptic ratings of blandness and acidity.

NUTS

305I. Pasteurization of black walnut meats.

ERICKSON, H. D., AND COLMER, A. R. *Food Res., 13,* 417-31 (1948).

Combinations of temperature and relative humidity effective in killing the coliforms on nut meats in a 30 min. period were as follows: 150° F. and 90%, 160° F. and 80% and 180° F. and 70%. A combination of 200° F. and 50% was also effective and required less treating time. It is suggested that a relative humidity of 50 to 70% be used as one of the factors of the pasteurization procedure. With such relative humidities the operation of the kiln is facilitated, the original moisture content of the nut meats is altered by little, and danger of mold growth in storage is small if the nuts are of proper dryness before processing.

306I. Effect of heat upon the nutritive values of peanuts. II. Riboflavin and pantothenic acid content.

DUNN, K. R., AND GODDARD, V. R. *Food Res., 13,* 512-17 (1948).

Microbiological assays for riboflavin and pantothenic acid were performed on Virginia-type raw peanuts. Other samples of the same peanuts were assayed following boiling, roasting at 160° C., and roasting at 180° C. for 40 min. period. The mean riboflavin value of raw peanuts was found to be 97 ± 4.92 μg. per 100 gm. and that for pantothenic acid, 2,715 ± 83.9 μg. per 100 gm. Boiling the peanuts produced a loss of approximately one-fourth of both riboflavin and pantothenic acid; while roasting them at 180° C. destroyed one-fourth the riboflavin and almost all the pantothenic acid. Roasting at 160° C. was the most favorable processing method, since none of the riboflavin and only one-fourth of the pantothenic acid was lost. It was concluded that peanuts are a fair source of riboflavin and a very good, or excellent, source of pantothenic acid following favorable processing.

VEGETABLES

307I. The effect of maturity and storage on the carotene content of carrot varieties.

BROWN, G. B. *Proc. Amer. Soc. Hort. Sci., 50,* 347-52 (1947); *Biol. Abst., 22,* 2363, No. 23489 (1948).

Carotene determinations were made on 9 carrot varieties at different stage of growth and on 8 varieties at different periods during winter storage. Varietal differences in carotene content were found. The carotene content of all increased up to 100 days after planting, then remained fairly constant until harvested at 135 days. In storage, the roots generally were found to have increased in carotene content at 30 days, then to have remained at the same level for 60 days.

308I. Effects of spraying a sprout inhibitor on potato plants in the field.

ELLISON, J. H., AND SMITH, O. *Proc. Amer. Soc. Hort. Sci., 51,* 397-400 (1948); *Brit. Abst., BIII, 17,* Jan. 1949.

Houma potatoes were sprayed on July 19 and/or August 19 and/or September 11 at the rate of 300 gals. per acre with aq. Me l-naphthylacetate, 3500 or 7000 p.p.m. July sprays reduced the yield and sp. gr. of the tubers. Sprouting in store was most reduced by the July spray, but the August spray had a significant effect. The lower concentration of the ester was as effective as the higher one. Tubers from the sprayed plants had lowered contents of reducing sugars.

309I. Losses of stored potatoes.

STUIVENBERG, J. H. M. VAN. *Landbouwk, Tijdschr.,* 706/708, 151-6 (1947); *Biol. Abst., 22,* 2366 No. 23521 (1948).

Storing 4 varieties of potatoes at 3, 5 and 7° C. until mid-April showed that sugar content was higher when stored at low temperatures. According to the varieties, the tubers could be unsweetened by storing the sweet potatoes at 10-13 or at 24° C. When sugar had been formed at very low temperatures (3-4 months at 1° C.), the Binje variety could not be unsweetened completely. Under ordinary storing conditions, loss of weight by evaporation may after 6 months, amount to 1% to 31%, probably according to variety and conditions of growth and harvest. Drying before storing is recommended against loss by microbes and fungi. In connection with losses by sprouting, the rest period is divided into preliminary rest, deep rest, after rest and dormancy. During after rest and dormancy, all sprouted, when stored at 10° C., only 1 out of 4 sprouted very much at 7° C., while 3° C. was perfectly safe. Treatment with glycolchlorhydrin 0.04 ml./l. at a dose of 10 ml. for 2.5 kg. of tubers greatly reduced sprouting. The effect of coumarin varied according to dose. Under various conditions of storage, all the varieties showed about 10 mg. of vitamin C in 100 g. of tubers. CO_2 storage was detrimental, application of growth substance beneficial.

310I. Investigation on asparagus. 1. Ascorbic acid.

WOLF, J. *Gartenbauwiss., 15,* 109-17 (1941); *Biol. Abst., 22,* 2367, No. 23524 (1948).

The ascorbic acid content decreased from the tip to the base of the asparagus spear. In white spears, the tip contained about 60 mg. ascorbic acid/100 g. fresh weight, the middle of the spear about 24 mg., and the base about 17 mg. In "blue" spears the tip contained about 90 mg. ascorbic acid, the middle about

(Selected Abstracts continued on page 9, following technical papers)

News of the Institute

ACHIEVEMENT AWARD

Presentation of Food Industries Award, 1949 *

Introduction and Remarks on Award Background

By F. K. Lawler

It is with some misgivings that we came to California to present an Award to a Florida citrus company. And probably no one but a naive New Yorker would dare to do such a thing. Yet when one studies the situation a little, he finds many common bonds between the two sunshine states.

Both states have governors by the name of Warren. And Florida's Governor Warren recently married one of California Governor Warren's charming lady citizens. So these two great states are united in holy matrimony.

If we get technical, the citrus process which won the Award started in California when Larry Heid was doing research work out here for the Department of Agriculture. Besides, that process is now being used in this state and probably will be quite as valuable to the food processing industries here as to those in Florida.

So we trust that Californians are every bit as interested in the progress in food technology implied in this award as are the technologists in other parts of the country.

This is the second presentation of the biennial Food Industries Award for achievement in food technology, the first having gone to Atlantic Coast Fisheries in 1947 for the automatic fish filleting process.

As we have previously announced, Florida Citrus Canners Cooperative wins the award this time for its particular process for producing concentrated frozen citrus juice. And we might point out here that the process is a nice combination of technology and engineering. This makes the award all the more appropriate at a time when there is a well-defined trend to advanced food plant engineering, as will be brought out at the discussion session here this evening.

The conditions governing the award competition were approved by the Institute of Food Technologists. The principal ones are:

1. The award is for an improved or novel process of food manufacture, not for a food product itself.

2. The process must have been in commercial use prior to the granting of the award.

3. The process shall have been put into commercial operation since V-E Day.

The Jury of Award consists of 26 members of the Institute and was appointed by President Dutch Diehl. All members are with institutions of higher learning, except one. He is with a health department. So no one on the Jury was associated with any company competing for the award.

If time permitted, I should like to read the names of the Jury members. However, they are listed in our special award article, copies of which you may pick up at the door as you leave this session.

Dr. Prescott served as Chairman of the Award Jury, and since he is engaged in running this morning's session, Dr. Cruess has kindly consented to make the Award presentation for him.

The Food Industries Award is made to a company and not to an individual. Its purpose is to encourage food processors to develop or adopt improved processes.

Such progress is essential to the continued rapid growth of food processing because of its influence in introducing new products, in improving the quality of existing products, and in reducing costs to broaden markets.

Progress of this type likewise is important to the welfare and economy of the nation and the world. It contributes to better health and better living. It helps our economy by providing more profitable markets for things the farmers grow. It also reduces the cost of food, allowing consumers to spend more for other things. This increases the business done by other manufacturers and raises the standard of living in general.

Looking beyond the borders of these United States, progress in food becomes vital to future peace. No less an authority than N. E. Dodd, former Under-Secretary of the U. S. Department of Agriculture, and now Director-General of the Food and Agricultural Organization of the United Nations, recently said:

"The filling of empty bellies is the number one problem of the world today!"

This filling of empty bellies requires the combined efforts of farmers, fishermen and food technologists.

But getting back to the Award, several excellent processes were entered in the 1949 competition. This is an indication of substantial progress in the commercial application of food technology and engineering. We want to compliment each company which entered the competition on the achievement represented by its advanced process. We also compliment each of these companies for an enlightened attitude in respect to talking about what it has done. The closed-door policy of progress-retarding secrecy is not on the books of the firms competing for the Award.

Our only regret is that we did not have an award for every company which entered the competition—and we mean this seriously, so excellent were the processes.

We look forward to future Award competitions which will involve processes as far-reaching in significance as did this one. And each company which did not win this time is invited to enter its process again in 1951. The invitation to vie for the next award is extended, of course, to all food processing companies.

I should like to thank the Award Jury for the excellent job which it did. And I want to express the appreciation of Food Industries for the fine cooperation of the Institute of Food Technologists in the selection of the Award winner and in the presentation of the Award.

Others on this presentation program will give you the details of the citrus process and interpret their significance, and do it much better than I could. But I should like to make one observation.

* Presented before the Ninth Annual I. F. T. Convention, San Francisco, July 11, 1949.

The final link in the chain of developments which made this process so highly successful was efficient heat utilization by way of what might be called the heat-pump principle. That is, heat was taken from one side of the process and pumped by way of refrigeration compressors to the other side, so that the power applied to the compressor motors did double duty.

It strikes me that the potentialities of this principle are worth study by other food processors, because heat and refrigeration both are used in so many of the industry's plants.

The biggest obstacle in the way of wide use of the principle is, of course, the fact that you are dealing with low-temperature heat and may become involved in extensive heat-transfer equipment. But some applications are practicable, others merit investigation.

I now have the honor and pleasure of calling upon Dr. W. V. Cruess, who will make the Award presentation. An outstanding food technologist, educator, author, past-president of the Institute of Food Technologists and above all a charming gentleman, Bill Cruess, of the University of California, needs no introduction to this audience. Dr. Cruess.

Remarks by Dr. W. V. Cruess, member of the jury for the 1947 Food Industries Award, acting for the Chairman, Dr. S. C. Prescott:

Dean Prescott, Ladies and Gentlemen: By way of explanation of my appearance in the role of speaker to present the 1949 Food Industries Award I feel that I should tell you this should have been Professor Prescott's honor and privilege, since he is Chairman of the 1949 Award Committee. However, Dr. Prescott was drafted to serve as presiding officer of this session, making it necessary for some other member of the committee to pinch-hit for him. So that is how it happened. Consequently, I urge Dr. Prescott and Mr. Lawler to feel free to call attention to any omissions or errors on my part and to add to or correct what I may say.

While we are at it we might mention that the award was won by a Florida canning organization and a Californian is making the presentation talk; showing there is no hard feeling between the food technologists of these two rival sun-kissed states.

First of all I wish to commend *Food Industries*, its editor, and management, for establishing this very worthy award, particularly on its present unique basis of open competition. It is not only a reward for accomplishment and progress in food technology; but it is also a very important stimulus to other progressive and enterprising food processors.

The first award was won by the Atlantic Coast Fisheries, Inc. of Boston and New England fish centers, for its continuous and automatic fish filleting machine. Their machine does a better job than hand filleting, and does it at lower cost and at great speed. Dr. B. E. Proctor of M. I. T. presented the 1947 award; there was none in 1948.

The responsibility for reviewing the documents of the competitors and for making the award was given to a jury or committee of twenty-seven men. The jury consisted of the following:

Dr. S. C. Prescott, Massachusetts Institute of Technology, Cambridge, Massachusetts, Chairman.
Baker, George L., Dept. of Chemistry, University of Delaware, Newark, Del.
Bedford, C. L., Dept. of Horticulture, The State College of Washington, Pullman, Wash.
Campbell, W. L., Dept. of Food Technology, Massachusetts Institute of Technology, Cambridge, Mass.
Cruess, William V., Dept. of Food Technology, University of California, Berkeley, Calif.
Douglas, Howard C., Dept. of Microbiology, University of Washington, Seattle, Wash.
Fabian, Frederick W., Dept. of Bacteriology and Public Health, Michigan State College, East Lansing, Mich.
Fellers, Carl, Dept. of Food Technology, University of Massachusetts, Amherst, Mass.
Fieger, E. A., Dept. of Agr. Chemistry and Biochemistry, Louisiana State University, Baton Rouge, La.
Garard, Ira D., Dept. of Chemistry, New Jersey College for Women, Rutgers University, New Brunswick, N. J.
Gould, Ira A., Dept. of Dairy Technology, Ohio State University, Columbus 10, Ohio.
Guerrant, N. B., Dept. of Agricultural and Biological Chemistry, Pennsylvania State College, State College, Penn.
Highlands, Mathew E., Dept. of Food Technology, University of Maine, Orono, Maine.
Howard, L. B., Dept. of Food Technology, College of Agriculture, University of Illinois, Urbana, Ill.
Levine, Max, Bureau of Laboratories, Dept. of Health, Territory of Hawaii, Honolulu.
Maclinn, Walter, Dept. of Food Technology, Rutgers University, New Brunswick, N. J.
Masson, Henry J., Graduate School of Engineering, New York University, University Heights, N. Y.
Nicholas, J. E., Dept. of Agricultural Engineering, Pennsylvania State College, State College, Penn.
Parker, Milton E., Dept. of Food Technology, Illinois Institute of Technology, Chicago, Ill.
Proctor, B. E., Dept. of Food Technology, Massachusetts Institute of Technology, Cambridge, Mass.
Pyke, W. E., Dept. of Chemistry, Colorado A & M College, Fort Collins, Colo.
Shellenberger, John A., Dept. of Milling Industry, Kansas State College, Manhattan, Kansas.
Shuey, George A., General Agricultural Chemistry Dept., University of Tennessee, Knoxville, Tenn.
Stewart, George F., Iowa Agri. Experiment Station, Iowa State College, Ames, Iowa.
Wiegand, Ernest H., Dept. of Food Technology, Oregon State College, Corvallis, Ore.
Woodroof, J. G., Dept. of Food Technology, Georgia Agricultural Experiment Station, Experiment, Ga.
Woolrich, W. R., College of Engineering, University of Texas, Austin, Tex.

A considerable number of food processing organizations entered the 1949 competition; and the products and processes represented were varied. They ranged from fruit concentrates to dairy products. All major sections of the U. S. A. were represented.

The committee members were supplied with comprehensive illustrated statements by the competitors. These were supplemented in several cases by reprints. The committee wishes to compliment all of the contestants on their very clear, informative and interesting presentations. All represented important advances in food processing or engineering; in most cases in both. It was extremely difficult to choose a winner.

Naturally, the various members of the jury showed a wide range of preference in their votes for first, second and third. However, the voting gave this year's winner

(News of the Institute continued on page 9, following technical papers)

Abstracts

(Continued from page 6, preceding technical papers)

30 mg., and base about 17 mg. per 100 g. In green asparagus, the tip contained 120 mg., the middle about 52 mg., and the base about 20 mg. per 100 g. The ascorbic acid content in the peel is always higher than in the pith-in the middle of white sprouts about 18%, in that of "blue" sprouts about 50%, and in that of green sprouts about 100% more than in the pith. At the base the differences between peel and pith are much smaller—about 17% more in white and blue, and about 50% in green. During cool storage for 4 weeks (—0.5 to 0° C.), a decrease of the ascorbic acid content of the tips to 25% of the content at the beginning of the storage period occurred. In the middle the ascorbic acid content showed at the beginning of storage a decrease of 20%, and thereafter, to the end of the trial, no noteworthy further decrease was found. In the base end, the ascorbic acid content decreased slowly but evenly from 17 mg. to 12 mg./100 g. fresh weight. For short storage at + 12.5° C. (48 hrs.) and at + 18.5° C. (24 hrs.) no noteworthy decrease of ascorbic acid content was evident.

PHYSICAL RESEARCH

311I. Use of dyes to determine the iso-electric point of gelatin.
DICKINSON, H. O. *Nature, 163,* 485-6 (1949).

The following technique has been found to give reliable and reproducible results. To 50 ml. distilled water add 0.5 cc. of 1% gelatin solution, followed by 0.5 cc. of 1:2,000 ethyl alcohol solution of 3:3'-dimethyl 5:5'-dichloro-9-ethyl thiacarbocyanine chloride. If as usual, the pH of the solution is above the iso-electric point, the color will be blue. N/100 HCl is added from a micro-burette until the color of the solution changes from blue to red. Each addition of acid is followed by thorough stirring of the solution. The end-point is reached when the last trace of blue color just disappears from the solution. Measurement of the pH of the solution at this stage gives the iso-electric point. If the end-point is overshot, addition of a slight excess of alkali will enable the titration to be repeated, and by this method several estimations can be made on one sample.

312I. A color translating ultraviolet microscope.
LAND, E. H. et al. *Science, 109,* 371-4 (1949).

An ultraviolet microscope takes three separate pictures of the same object at three separate wavelengths in the ultraviolet. The film is automatically processed, and within ten seconds the three pictures are projected simultaneously, each in a different color. The result is a color representative of the object as it might appear to the eye if ultraviolet light were visible. The instrument uses a motion picture camera.

313I. Starch solutions and pastes and their molecular interpretation.
MEYER, K. H. et al. *J. Phys. Colloid Chem., 53,* 319-34 (1949).

Starch solutions and pastes exhibit peculiar properties which can only be understood through a thorough knowledge of the physical-chemical behavior of the individual components of the starch granule, and in addition, of the morphological organization of the granule. Both components—the unbranched, termed "amylose," and the branched "amylopectin"—show in solution the phenomenon of "aging." This consists in an aggregation of molecule to micellae and finally to a ppt. or a more or less turbid gel. New methods are described to check the purity of amylose and to determine the molecular weight of the components of starch. The results obtained explain the difference in behavior of corn starch and potato starch which is shown, e.g., in swelling capacity, viscosity, and rate of solidification of the respective solutions and pastes.

314I. The structure of starch. The ratio of non-terminal to terminal groups.
BROWN, F., et al. *J. Chem. Soc., 27-32* (1948).

An assay of the proportion of terminal groups present in various starches has been made by measuring the amount of formic acid liberated on oxidation of the polysaccharide by potassium periodate. The results obtained are in good agreement with those derived by measurement of the amount of tetramethyl methylglucoside resulting from the methanolysis of the corresponding methylated starch derivatives. Few, if any, glucose residues linked solely through carbon atoms 1 and 6 can therefore be present in starch. The amylose component of certain starches has been examined and shown to contain approximately one non-reducing end-group for every 250 glucose residues. The yield of formic acid produced on oxidation of the whole starch with potassium periodate, combined with an estimate of the amylopectin content of the starch obtained iodometrically, has enabled a calculation to be made of the ratio of terminal to non-terminal groups in the amylopectin component. For many varieties of amylopectin this ratio is 20:1, but there are exceptions, for example, the amylopectin component of potato, sweet potato, and arrowroot starches, where the ratio is higher.

News of the Institute

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a very substantial majority. The jury would remind the competitors that they are eligible to compete again next year and desires to encourage them to enter again.

In the speaker's case the documents arrived while he was laid up in the hospital with an assortment of broken bones. Reading of the competitors' statements was really beneficial to his recovery by taking his mind off his aches and pains.

Editor Lawler of *Food Industries* gave us several basic factors to consider in evaluating the competing processes. Among these factors were: technological significance, economic importance and success in its special field; protection of the foods handled with reference to sanitation, purity, quality and appearance; possible application in other fields, that is, is it limited to one narrow sector or generally applicable; freedom from operating difficulties; saving in time and of food; complexity or simplicity; and must have been put into operation since V. E. Day, May 8, 1945. The winner's process, equipment and product met these requirements.

The present accelerated pace in advancement in processing technology and engineering makes it necessary for all food processors to keep up with the trend and contribute to further progress. The Food Industries Award competition and annual I. F. T. Conventions do much to keep us abreast.

From personal knowledge we can say that for at least thirty years the citrus industry has been looking for a thoroughly satisfactory orange concentrate. There was needed a citrus concentrate that would on dilution taste like fresh juice and that would not deteriorate in storage. Many wild, fantastic and unsatisfactory processes were invented, and many financial angels lost much money in such schemes.

The Exchange Orange Products Company of Ontario, California, was one of the first to install stainless steel vacuum pans to operate at higher than customary vacuum and lower than usual temperature for production of orange concentrate. Other producers in Cali-

fornia, also, and in Florida installed improved vacuum pans and over the past twenty years have produced considerable concentrate for use in carbonated beverages, frozen desserts, etc., and for shipment overseas for use as a source of vitamin C as a beverage base, particularly for children. While such concentrate if flavored with orange oil gives a fairly palatable drink on dilution with water, it is lacking in fresh flavor and darkens on storage. Still the output in 1947 was around 4,000,000 gallons according to *Western Canner and Packer*.

Canned orange juice while it attained a pack of over 19,000,000 cases in one recent year, also lacks the flavor of fresh orange juice. That was the picture before the new frozen 3 plus 1 concentrate came on the scene. It has been such a great and rapid success that it threatens to steal the spotlight among frozen foods. In some markets it has outsold frozen pack peas, heretofore the number one frozen food in sales volume.

It might be well at this point to mention several of the milestones in the evolution of the process now used for frozen orange concentrate. One of these was a procedure and several machines for continuously concentrating fruit juices and other food liquids by freezing out some of the water and removing it as ice, as developed by Eudo Monti of Italy some forty years ago. A contemporary of Monti was H. C. Gore of the U. S. D. A. who used a centrifuge to separate the ice from the concentrate. More recently Stahl and Jordan in Florida have used a modification of this procedure. They preserved the concentrate by freezing. Joslyn and Hohl state that Stahl and Jordan added fresh juice and juice sacs to their concentrate to improve the flavor and appearance.

While freezing concentration gives concentrates of fresh flavor, it is less convenient to use than vacuum concentration and requires several cycles to attain 50-55° Balling. Some thirty years ago M. K. Serailian patented a process of vacuum concentration in which the volatile flavor constituents were recovered from the distillate and returned to the concentrate.

During the recent world war, evaporation of moisture from the chilled product at very high vacuum and very low temperature was developed. Vacuum Foods Corporation and others pioneered this process and developed equipment for it. It is reported that results were very good.

Among investigators whose research was more closely related to the procedure used by the Florida Citrus Canners Cooperative were J. L. Heid, now of that organization; Dr. L. G. MacDowell, Dr. E. L. Moore and Cedric D. Atkins who are members of the Florida Citrus Commission. The Commission members applied for a patent in 1945. Recently granted, the patent was turned over to the public for use without royalty. It specifies concentration at not above 80° F.; concentrating in vacuo five to eight fold, diluting with fresh juice to a concentration that permits 3 to 4 fold dilution with water at serving, deaerating, sealing under vacuum and preserving by freezing.

The Florida Citrus Canners Association procedure was similar and operated at exceptionally low temperatures to eliminate heat damage to flavor. In an article in *Food Industries* in 1948 J.L. Heid and C. G. Beisel of the Association make the following statement: "Using equipment and methods planned by L. G. MacDowell, Director of Research, Florida Citrus Commission, and J. L. Heid, then Director of the U. S. D. A. Citrus Products Station, Winterhaven, Florida, MacDowell, Moore and Atkins concentrated juice at low pressures without modifying the taste. The flavor of the concentrate was flat, however, due to loss of volatile constituents. But these investigators developed a process for concentrating the juice to 60 percent solids, then adding sufficient unconcentrated juice to reduce the solids to 42 percent. This produced a concentrate which when reconstituted after freezing, could not be distinguished by most tasters from the fresh juice."

That in brief is the process and the product of the Cooperative. The concentrator is very unique in principle and design. It was conceived and designed by Joseph Cross of Mojonnier Brothers Company of Chicago and was built by that company, which also built the pilot plant that preceded the commercial installation. It uses the ammonia refrigerating system; first to provide heat at about 105° F. from the warm ammonia from the compressor and second to provide cooling for condensing the water vapor by the cooling action of expanding ammonia at 45° F.

The final product is at about 42° Balling or Brix. The housewife buys it frozen in 6 ounce cans; opens the can; adds 3 volumes of water; mixes and serves a cold juice of fresh flavor. The brand name of the product is Donald Duck. Try it some time.

It should be pointed out that the Mojonnier Lo Temp Evaporator and the Cooperative's product have application to other products. One company at least is producing a frozen grape concentrate; others are considering or producing other concentrates such as grapefruit, lemon and prune. It is applicable to such products as milk, pectin solutions, table syrups, cereal extracts and syrups, liquid egg, certain pharmaceuticals, sucrose juices, etc. Therefore, it has rather wide application; one of the requirements considered in making the award.

The present speaker has for many years known of "Larry" Heid's research on citrus products for the U. S. D. A. in Florida and California and for the Cooperative at Lake Wales. He deserves much of the credit for devising and developing the final commercial process and product. However, I would like to mention Joseph Cross of the Mojonnier Brothers Company, who decided on the type of Vacuum Concentrator to be built; who designed it and supervised its construction and installation. He cooperated closely with Dr. Heid and others; and deserves great credit for the originality of the equipment design and for its successful installation and operation.

Heid and Beisel of the Florida Citrus Canners Cooperative described the equipment and process quite fully in *Food Industries*, volume 20, pages 516-518, 1948. Cross and Gemmill in the same journal, volume 20, pages 1421-1423, 1948 describe the equipment fully. Readers are referred to these articles for details.

The Frick Engineering Company furnished the compressors and other refrigerating equipment. In their

journal, The Frick System, volume 20, pages 1-3, August-September, 1948 they give an outline of the process and equipment.

There are present here in addition to Dr. Heid, representatives of Mojonnier Brothers Company and of the Frick Company who can give additional information.

The jury wishes to congratulate the Florida Citrus Canners Cooperative on the successful attainment of its high goal of producing commercially and distributing nationally (including California) a frozen pack concentrated citrus juice of fresh flavor, aroma, and appearance. We likewise wish to highly compliment research workers of the Cooperative, of the Florida Citrus Commission, of the U. S. Department of Agriculture, and the Florida Agricultural Experiment Station for the essential, well conceived and capably executed research basic to the present commercial procedures used in this process. To the engineering staff of the Mojonnier Brothers Company and its plant personnel go our congratulations for originality of principle, design and construction of the low temperature evaporator that made the process feasible. We wish also to compliment the Frick Company for its very important part in adapting its ammonia compressing and refrigerating equipment to the proper and efficient handling of the refrigerant in the evaporating system.

And again the jury wishes to compliment the other competitors for their very great contributions to advances in food technology. Editor F. K. Lawler, of *Food Industries*, and Dr. Samuel Prescott, Chairman of the Award Committee, deserve generous recognition for their efficient conduct of the contest.

In presenting this, the second Food Industries Award to you, Mr. D. A. Hunt and the Florida Citrus Canners Cooperative of Lake Wales, Florida; the jury hopes that your successful solution of an old and difficult problem in food technology will be an inspiration to others who are striving to improve food products and processes or to devise and develop new ones. Our sincerest congratulations!

Mr. D. A. Hunt will speak on behalf of the Cooperative.

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Remarks by F. K. Lawler, introducing D. A. Hunt, President, Florida Citrus Canners Cooperative:

As top executive of the company winning the Award for outstanding achievement in food technology, Mr. Hunt is to be commended for his wisdom in backing a winner with a big investment. The commercial possibilities of the frozen concentrate were realized in 1944. And the new and revolutionary plant to produce this product was completed in 1948. In the 4-year interval Mr. Hunt never faltered in his conviction that the progressive step his company was taking was worth the cost. That he was 100 percent correct is now a matter of history.

We know that all food technologists appreciate the value of top executives like Mr. Hunt. Without them the developments made by the technologist and the engineer never would reach that satisfying stage of commercial application.

Incidentally, Mr. Hunt studied citrus culture at the University of Florida after serving in World War I, and he has been engaged in the citrus industry ever since.

Remarks by Mr. D. A. Hunt:

Dr. Cruess, Members of the 1949 Conference of Food Technologists, Ladies and Gentlemen: It is a great pleasure and honor to receive this award on behalf of the Florida Citrus Canners Cooperative. I want to express my thanks to Mr. M. A. Williamson, Vice-President of McGraw-Hill and publisher of *Food Industries* and to Editor F. K. Lawler for making possible this award. It is also my privilege to express our appreciation to the Institute of Food Technologists for making this presentation a part of the Conference Program.

To the twenty-six Professors of Food Technology who acted as judges and saw fit to select us for this honor must go our deepest gratitude. While we are naturally proud of our process for preparing frozen concentrated citrus juices without modification of flavor or food value, I am sure that the distinguished members of the award committee were faced with a tremendously difficult decision in judging among the many outstanding contributions to food processing which have been made within the recent past.

The importance and skill represented in competing processes add luster to the honor which we have received. We are proud to have been selected from such a distinguished field of contenders for this honor, but we are also humble in the realization that we only symbolize the entire field of nominees, since not all could be selected for this presentation.

I should also like to tell you that you are today honoring no individual but some fifteen hundred growers whose courage and foresight made the materialization of this process possible. Our company was organized in 1930 and the first year handled approximately 40,000 boxes of fruit. Today we are equipped to handle over 40,000 boxes of fruit per day.

Reading the inscription on this handsome plaque, which we shall proudly display in Lake Wales, I note the wording: "In recognition of its contribution . . . made possible through a broader participation by food technologists in the affairs of the food processing industry." On behalf of top management, I should like to say that I doubt if a more appropriate statement could have been devised.

The process which is being honored today was conceived in our Research and Development Department which presented it to the management with the recommendation for pilot plant tests. When these tests, conducted with the valued cooperation of equipment manufacturers, were successful, the confidence of our Board of Directors was sufficient to persuade them to appropriate half a million dollars for buildings and equipment which had to be completed before the first commercial package of frozen concentrated orange juice could be produced.

Those results have justified that confidence, which was based upon the fact that for six years our Research and Development Department, its staff members trained in engineering, chemistry and bacteriology, had played an important role in our operation and expansion to a point where we can now process forty to fifty thousand boxes of oranges, grapefruit and tangerines per day into a wide variety of citrus products.

Today we have invested approximately one and a half million dollars in our frozen orange concentrate plant and about four million dollars in our entire operation. Yes, on behalf of Management, it is a pleasure to acknowledge that this contribution was made possible through a "broad participation of food technologists in the affairs of the food processing industry."

I will not attempt to describe the technical phases of the process as that subject will be discussed by Larry Heid who is, I believe, known to most of you. It is rather my purpose to accept this award with the heartfelt gratitude of fifteen hundred Florida citrus growers who are honored here. As their representative, may I repeat my thanks to *Food Industries* magazine, to the Institute of Food Technologists and to the distinguished judges who have accorded us this honor.

Remarks by F. K. Lawler, introducing Larry Heid, Director of Research, Florida Citrus Canners Cooperative:

To supplement the very interesting and pertinent comments by Mr. Hunt, I am going to call upon Larry Heid. As director of research at Florida Citrus Canners Cooperative, Larry had a big hand in developing to outstanding commercial success the process which won his company the award. He is a citrus technologist from 'way back. Many of you who are from California know of the work which he did on the staff of the U. S. Fruit and Vegetable Chemistry Laboratory at Los Angeles 20 years ago.

There he observed that flash heating in high-velocity tubular heaters improved the flavor of canned citrus juice. He also made tests showing that juice which was deaerated, canned and quick frozen could be held at zero degree F. for several years without perceptible deterioration in flavor.

Larry continued his work on processing citrus juice as director of U. S. D. A. Citrus Products Station in Winter Haven, Fla. Here a distinct improvement in the flavor of the juice was made by adding unconcentrated juice to the concentrated product. At this point, Florida Citrus Canners Cooperative decided that frozen concentrated citrus juice had real commercial possibilities. So Larry's part in the development of the award-winning process extends over a period of two decades. Larry, will you tell them about your process and its significance? Mr. Heid.

Remarks by Mr. J. L. Heid:

The President of the Cooperative, Mr. D. A. Hunt, has told you of the part played by management in the development which is being honored. I have been invited to review this development and discuss some of the economic aspects of frozen concentrates.

I

Many individuals contributed directly or indirectly to this development. In 1929, in a barn of a building on South Mission Road in Los Angeles—a Federal laboratory under the direction of E. M. Chace—your speaker began to study the effect of variations in processing methods and storage conditions upon the flavor and keeping quality of citrus juices.

Time will not permit mention of everyone whose work cleared the trail leading to the Lake Wales process, but specific mention is due to those with whom the speaker was directly associated, including Poore, Scott, von Loesecke and Mottern.

Later at Winter Haven, Florida, work was continued in cooperation with MacDowell, Moore and Atkins who later demonstrated a practical method for preparing frozen concentrated citrus juice with the natural flavor of freshly squeezed juice. With this evidence of commercial possibilities a method was sought for preparing uniform, top-quality products at nominal cost on a large scale.

Objectives included:

1. A higher degree of sanitation than had been previously achieved.
2. Uniform high velocity, low temperature concentrating, blending and freezing of juice from selected fruit.
3. Minimizing elapsed time from extraction of juice until amorphously frozen products were sealed out of contact with atmospheric oxygen.

The skills of several equipment manufacturers were enlisted and contributed importantly to the development of a process so different from any previously used that more than two years were required to progress from pilot plant tests to commercial operation.

Special mention is due to the work of J. A. Cross who designed an evaporator to meet specifications which included:

A. Temperature of heating medium not to exceed 115° F.

B. Falling film, multiple stage, single effect evaporation with maximum juice temperature of 60° F. and maximum retention time not to exceed ten minutes.

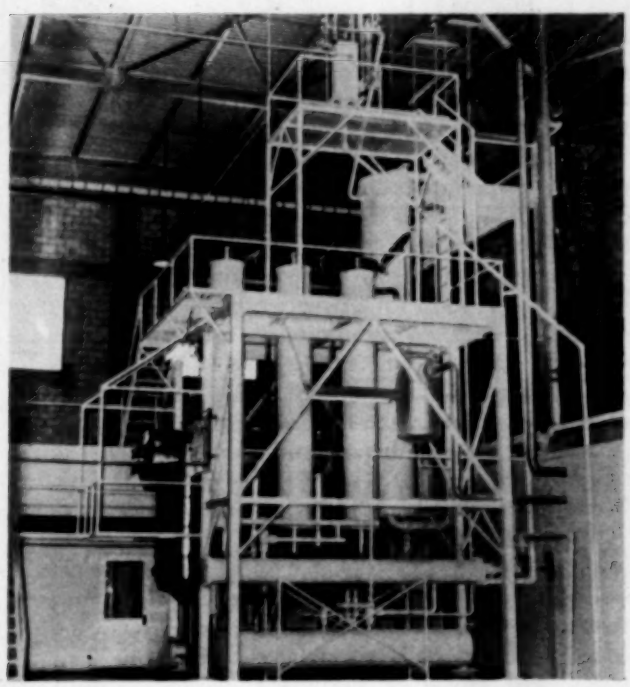
C. Sanitary design which would permit complete cleaning and sterilization and operate without appreciable build-up in microbiological counts.

To achieve such operating conditions in Florida where minimum cooling water temperatures are 80° F., it is

necessary either to compress vapors before condensing or resort to refrigerated condensers. In the Lake Wales process a three stage, single effect, falling film evaporator is operated without steam. Ammonia is compressed in a conventional refrigeration compressor. Latent heat liberated by the condensing ammonia is used to evaporate water from the juice, then vapor from the juice is condensed by evaporating the ammonia. Surplus heat of compression may be removed by warming incoming juice or dispelled in cooling water.

An engineering advantage of this system is that the two pounds of ammonia which must be compressed to provide 1058 B. T. U. occupy a space of only 7.2 cubic feet at 45° F., instead of the 1,208 cubic feet occupied by one pound of water vapor at 60° F. Consequently, a small compressor may be used instead of a large one.

The heat balance of the system has been described by Cross and Gemmel on pages 1421-23 of *Food Industries*, Volume 20, 1948. The initial unit was operated by a 300 h.p. direct connected 4 cylinder, 11″ x 10″ compressor. After four evaporators of this size were installed two larger evaporators were ordered, which are operated by 700 h.p. compressors. This gives a production capacity of 1,000 gallons of 42° Brix frozen concentrate per hour.



Original ammonia compressor operated, three stage, single effect, falling film evaporator in production of concentrated frozen citrus juice by Florida Citrus Canners Cooperative. Latent heat of evaporation furnished by condensing compressed ammonia. Vapors condensed before compression by evaporating liquefied ammonia.

II

In operation, fruit is selected by testing in the grove and again upon delivery to the plant, and is sorted twice to remove every defective fruit. It is also washed three times with special detergents developed during a three year study to provide substantially sterile outer surfaces on fruit entering the extractors.

After extraction, the juice is strained through coarse and fine finishers. Finely strained juice is deaerated and chilled in an ammonia jacketed tubular heat exchanger, before going to the balance tank which supplies the evaporators. This is to prevent enzyme action and growth of microorganisms. After four minutes in the evaporators at 56° F., juice which entered at 10 to 12 percent solids is pumped out with the solids content increased to about 58 percent, and is transferred to cold wall blending tanks in which it is chilled to 26° F. while being combined with pulpy cut-back juice to adjust the soluble solids to exactly 42 percent.

After standardization, it is pumped continuously through a three cylinder slush freezer in which it is cooled to 17° F. at which temperature it has the consistency of sherbet and approximately one-third of the water content is frozen.

The slush is filled in six or thirty-two ounce cans which are sealed under steam blast to exclude air. Then the cans are conveyed through an air-blast tunnel freezer at minus 30° F. to complete the freezing process in two hours, before the cans are cased.

Clean up methods, sanitary and microbiological control procedures were developed by C. G. Beisel. Chemical tests are supervised by S. S. Thompson, and laboratory control is applied by laboratory and production personnel from the time the fruit is harvested until the finished product is released for shipment. Standards have been developed in the plant to insure high quality and uniformity. Routine tests are made for solids, acids, vitamin C, pulp, essential oil and flavor, and total microorganisms. Tile floors and walls in the plant facilitate cleaning. The specially designed and constructed plant represents an investment of approximately one and one-half million dollars, or about $1,500 per gallon of hourly capacity.

Improvements in process and equipment are constantly sought. Evaporator performance has been studied and improved. Initial production is delayed until fruit of suitable varieties is fully ripened. There is an appreciable variation in the process used for oranges and grapefruit juice to compensate for the higher enzyme activity in grapefruit juice. Demand for products has at all times exceeded continuously expanded plant capacity. This is true only because uniform top quality has been guarded so zealously that samples selected at random have repeatedly been preferred to freshly squeezed juice in blindfold group taste tests.

This process of evaporation employed in preparing frozen concentrated orange juice is applicable to a wide variety of biological extracts sensitive to temperature changes. These include blood serum, milk, eggs, fruit juices, antibiotics and similar products. Variations may be applicable for heavy industrial uses, particularly in areas where steam is difficult or costly to generate, or condensing water is limited. Multiple effect evaporators can be constructed to make use of the same principle.

III

Among the questions which are asked most frequently are:

What is the outlook for frozen concentrate?

Does the current boom represent a temporary fad or a revolution in consumer habits?

If high quality products meet an increasingly enthusiastic reception, how fast will production be expanded; what benefits and what hazards will be involved immediately and ultimately for growers, processors and frozen food distributors?

In attempting to answer these questions many unpredictable factors must be considered. There is a prospect that many additional processors will rush into the field of producing frozen concentrate, and how well they may be equipped to produce uniform high quality products and market them constructively remains to be determined.

The prospect for the 1950 season is that there will not be sufficient fruit of suitable quality to operate expanded production facilities to capacity. Whether this will result in poor products, and, if so, what the effect upon the general market will be remains to be seen. The need for quality standards is recognized, but unfortunately no one has been able to propose standards which will accomplish the desired purpose. It may be feared that hastily contrived State standards may have the opposite effect from that for which sponsors hope.

In the past, growers have tended to look upon citrus product manufacture as a salvage operation for grades, sizes and quantities of fruit which could not be profitably shipped to fresh fruit markets. Growers are coming to realize that frozen concentrate with a saving in shipping weight of more than eighty percent can provide quickly and conveniently at any time the full flavor and food value of freshly squeezed juice with no labor, delay or cleaning operation. Such a product cannot be looked upon as salvage; it is a new method for marketing the citrus crop.

Florida stands at a cross roads in marketing methods. If intelligently and constructively developed, frozen concentrated citrus juice offers an unprecedented opportunity to expand markets for citrus fruits in beverage and food fields, because frozen concentrate can be quickly and easily served and is superior in both flavor and food value to soft drinks which enjoy tremendous popularity. Such products have achieved great popularity because they were wisely promoted and because they were stable, easy and profitable to serve. Now, finest flavored orange juice with the flavor and food value of a freshly squeezed product can be served easily at competitive prices.

At 25 cents retail for a six-ounce can (which makes 24 ounces of juice), the price is approximately the same as that of popular carbonated beverages. This year, following the freeze in California and Texas, retail prices were forced to somewhat higher levels by the cost of fruit, but as each six-ounce can represents the juice of approximately 4.3 pounds of oranges, at thirty cents retails this quantity of juice still represents a great bargain when an equivalent quantity of fruit is retailing for fifty cents.

So many startling statements have been made regarding pricing of this product that some consideration of the economic aspects of production are warranted. In Florida the unit of measure for oranges is a ninety pound field box. The cost of producing a box of fruit may vary from 60 to 90 cents, depending upon the size and efficiency of the grove. For all practical purposes an average production cost may be considered at 75c per box and the cost of picking and hauling to processing plants may be estimated at 25c, so a dollar a box may be considered as the minimum price for fruit which will return production costs.

During the 1949 season the price of good oranges for frozen concentrate ranged from $1.00 to more than $3.00 per box, delivered to plants.

A simple calculation reveals the range in concentrate cost represented by this variation. As the yield of concentrate from good oranges of suitable quality ranges from 20 to 23 six-ounce cans per box of fruit, a conservative cost may be calculated upon the 20 can yield, and it is quickly seen that at $1.00 per box the fruit cost is five cents per can, at $2.00 per box it is ten cents a can and at $3.00 per box it is fifteen cents per can.

Can and carton cost is approximately 2.2 cents per can to be added to the above, bringing the cost to $.072, $.122 and $.172 per can for fruit, cans and cartons at the price levels mentioned for fruit.

To these costs must be added the cost of: cleaning and sorting fruit, processing, packaging, freezing, storing and loading the juice, sanitation and waste disposal, control research and development, overhead, including management and depreciation on costly facilities, sales and promotion and normal profit. This will give the net f.o.b. cost of finished products. These costs will vary inversely with the size of operations and directly with quality. Some processors claim to be able to cover these costs with four cents a can. Other estimates range as high as six cents.

Using the lower figure, it is seen that with fruit at two dollars a box, and with a twenty can yield, the minimum net cost of frozen concentrate at the processing plant will be $.162 per can. Freight and the cost of wholesale distribution and retail sales must be added. These costs range from five to ten cents a can, so that a retail price range between twenty and thirty cents is required to return growers $1.00 to $3.00 per box of fruit delivered to concentrating plants.

Substitution of inferior fruit or processes to permit lowering of prices is probably suicidal. Canned single strength juice offers the cheapest method of supplying consumers with the food value of citrus fruits. Frozen concentrate can go farther and provide them with the unimpaired flavor of the finest, freshest fruit, economically at a price which competes with that of fresh fruit, plus the advantage that waste and labor are eliminated. Frozen concentrate should not merely taste a little better than canned juice. It should taste as good as the best fruit the consumer ever tasted, if it is to provide citrus growers with an expanding profitable market for their crops. Nothing less than the best will do.

Whether this remarkable technological development will prove a boon or a curse will depend upon the men who control it, which is a major reason why Florida growers are organizing to work for a more orderly marketing of their crop.

(News of the Institute continued on page 16)

INDUSTRIAL ENZYMES

Which of These Will Improve Your Products?

Enzyme System	Designation	Availability	Action on Substrate
Pectinolytic	PECTINOL	Commercial	Demethoxylates pectic substances and hydrolyzes them to galacturonic acid. pH range 3.5 - 5.
	Pectin esterase	Experimental	Demethoxylates pectin without hydrolysis of the galacturonic acid chain. pH range 3.5 - 5.
Proteolytic	RHOZYME P-11	Commercial	Hydrolyze proteins to peptides and amino acids. pH ranges 5.5 - 8.5. (Relative amounts of peptides and amino acids will differ for each proteolytic enzyme.)
	Protease 15	Experimental	
	Protease 16	Experimental	
Amylolytic	RHOZYME S	Commercial	Hydrolysis of starch to dextrins, maltose and glucose. Contain both an alpha amylase and a strong glucogenic principle. pH range 5 - 6. RHOZYME S is a purified enzyme; RHOZYME T-22 the crude product.
	RHOZYME T-22	Commercial	
	RHOZYME DX	Commercial	Hydrolysis of starch to dextrins. Heat stable. pH range 5.5 - 6.5.
Lipolytic	Lipase A	Experimental	Hydrolysis of fats to glycerin and fatty acids. pH range 5 - 7.
Lactase	Lactase A	Experimental	Hydrolysis of lactose to glucose and galactose. pH range 6.1 - 7.5.

Commercially available Rohm & Haas enzymes are being used *now* in the following industries:—Fruit juices, jellies and fruit juice concentrates, protein hydrolysates, baking, corn starch industries, fermentation. Have you stopped to think how these materials might improve your product or manufacturing process?

Start with your own natural products which contain pectins, proteins, cellulose, fat, starches or milk sugar. Consider the possibility of changing viscosity, texture, solubility, clarity or filterability of your product at any processing stage. Will the hydrolysis of one of these substrates permit better utilization of others?

Do you want a clearer product—one that filters or presses more readily? Will the end result of hydrolysis be a product that's better utilized, better tasting? Don't forget the possibility of recovering fiber, fat, sugar or protein in waste products.

Whenever you desire mild conditions of hydrolysis, or when you require flexibility in hydrolyzing only one of several components of a natural product, consider Rohm & Haas standardized enzymes. Write us about your problems and ideas. We'll be glad to send you our suggestions, samples, technical literature—or consult with you personally, all without obligation.

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CHEMICALS FOR INDUSTRY

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Sodium Fluosilicate—Uses in Food Industry

A means for saving industry several hundred million dollars each year by eliminating damage caused by rats to packaged foods and other products has been suggested by Clifford A. Hampel, supervisor of inorganic technology at Armour Research Foundation of Illinois Institute of Technology.

Some estimates place the annual loss to industry caused by rats at more than a billion dollars, Hampel said. Warehousers assume that they will suffer an average loss of 15 percent of the value of stored articles through damage caused by rats.

Hampel believes that sodium fluosilicate, properly coated on the outer surface of paperboard shipping cartons, would be an effective rat repellent. He also suggests that it might be applied in the glue lines of the paperboard, or incorporated in the paperboard itself at the time of manufacture of the chip layer and liner sheets.

Critical studies to evaluate these possibilities are now being carried on with the aid of Dr. James B. DeWitt, U. S. Fish and Wildlife Service, Patuxent Research Refuge, Maryland.

"Sodium fluosilicate incorporated in food in very small quantities has caused rats to refuse the food over a four-day test period," Hampel said.

The chemical has the advantage of being an irritant and repellent to warm-blooded animals, even in small quantities, but has not been considered a dangerous poison, Hampel said.

He pointed out that before World War I it was used as a food preservative in Europe. Such use is prohibited by the Food and Drug Administration in this country. The compound actually is less toxic to warm-blooded animals than most of the common economic poisons, he said.

Hampel points out that potential production of sodium fluosoilicate, a by-product of the phosphate industry, is much greater than present consumption. This fact caused him to become interested in possible uses for this "overlooked and neglected chemical," which he says was "passed by in the development of new chemicals and novel processes."

Chief use of the chemical at the present time is as a "sour" to neutralize alkalinity in the final rinse water at commercial laundries (much as lemon juice is used in rinsing the hair). Small quantities are used as a flux in the metals and ceramics industries, and in some insecticides.

Hampel said that his studies have pointed up several other possible uses for sodium fluosilicate. He believes the chemical, or compounds including it, will be the answer to the question of how to stop dry-rot fungus in building materials made from the coniferous timbers, chiefly the type of fungus prevalent in the Gulf Coast and Pacific Northwest regions. More than 1¼ million tons of insulating board are made from these timbers each year.

Sodium fluosilicate, he believes, could be used as an effective weed killer; to defoliate cotton plants (kill the leaves and cause them to fall off) in preparing them for the picking machine; to sterilize the soil in preparation for planting certain plants, chiefly tobacco; as an insecticide in the control of weevils, cutworms, and other pests including even cockroaches, the housefly, and the moth.

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News of the Institute

(Continued from page 14)

COUNCIL EXECUTIVE COMMITTEE

Dr. Carl R. Fellers, President of the Institute of Food Technologists, announced the election of the following Councilors to the Council Executive Committee of the Institute:

W. L. Campbell—Massachusetts Institute of Technology, Cambridge, Massachusetts
B. S. Clark—American Can Company, Chicago, Illinois
H. T. Griswold—Owens-Illinois Glass Company, San Francisco, California
W. D. Pheteplace—Pfaudler Company, Rochester, New York
Geo. F. Steward—Iowa State College, Ames, Iowa

Alternates:

R. B. Wakefield—Gerber Products Company, Fremont, Michigan
E. E. Meschter—American Preserve Company, Philadelphia, Pennsylvania

The Executive Committee is scheduled to meet in Chicago, October 30, 1949, where Colonel Charles S. Lawrence plans to open the national offices of the Institute at 222 West Adams Street, Chicago, on October 1, 1949.

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